



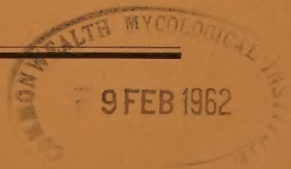
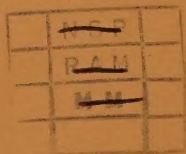
TANGANYIKA

MINISTRY OF AGRICULTURE AND CO-OPERATIVE
DEVELOPMENT

Annual Report
of the
Department of Agriculture
1960

PART II
(*Research*)

1961
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Annual Report

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Department of Agriculture

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PART II

(Research)

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It is hoped that a few minutes of harvest hours for working purposes, before the
 with some of the most important crops of our state and the most important products of
 that report to be a growing market.

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TANGANYIKA

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, 1960

PART II

INTRODUCTION

During the year Mr. J. B. D. Robinson was appointed Principal Scientific Officer (B) and took charge of the Coffee Research Station, Lyamungu. Mr. K. G. Pickles and Mr. J. Evans were appointed Agricultural Chemists and posted to the Central and Western Regional Research Centres respectively. Mr. J. T. Barton was appointed Agricultural Officer and posted to the Central Regional Research Centre for irrigation studies. Mr. G. A. Simiti, Experimental Officer, returned from England where he received advanced training at the Plant Breeding Institute, Cambridge.

Mr. F. B. Sanders retired from the post of Senior Research Officer, Lyamungu. During his tenure of this appointment he rendered valuable service to the coffee industry of the country.

A number of officers attended the meetings of the various specialist Committees organized by East African Agriculture and Forestry Research Organization and in this way made valuable contacts with the research work being carried out by that Organization in Kenya and Uganda.

A further grant was received from C.D. and W. funds to continue a former scheme and to assist in its expansion.

During the year responsibility was assumed for the Seatondale Experimental Farm belonging to the Southern Highlands Non-native Tobacco Board preparatory to purchase.

With the appointment of two Agricultural Chemists and the return of a third from secondment to the Rufiji Basin Survey the research centres are fully staffed in this respect and work on soil studies in connection with soil fertility and land use surveys is increasing considerably.

A seeds laboratory was equipped for use in the new seeds certification scheme. Seeds other than beans are accepted for testing in special circumstances. The Seeds Board of Tanganyika supplied some of the equipment for bean seed testing. Close liaison is maintained with Kenya in plant pathological matters by means of regular two-monthly meetings for discussion of current problems. Fusarium wilt of cotton continues to spread in Lake Province. The selection programme on wheat continues to produce new varieties of wheat to replace those whose resistance to rusts has broken down.

The examination of individual Rhodes grass plants raised from seed has shown that a wealth of variation exists which could be exploited to produce improved planting material. Although maize varieties with a very short growing period have not been produced, some success in shortening the growing period has been achieved. The sesame variety Morada, introduced from Venezuela, maintained its original promise for producing higher yields than most local types. It is also proving valuable in the breeding programme.

It is hoped that a few varieties of haricot beans, for canning purposes, selected from a wide range of introduced varieties may prove of real value and stimulate production for what appears to be a promising market.

In the pyrethrum research programme the presence of limestone and phosphate has been found to give appreciable increases in yield in the first year of planting out. A wide range of clonal material showing promise is now available and a crossing programme to produce improved seed has started. The Pyrethrum Board of Tanganyika has provided some special equipment for this work.

An extensive cashew research programme has been successfully started in the Southern Province on a wide range of problems.

B. Simon was awarded a Commonwealth Scholarship for two years to study plant pathology at London University.

STAFF—RESEARCH DIVISION

(As at 31st December, 1960)

HEADQUARTERS

Chief Research Officer: A. C. Evans, B.Sc. (Bristol), D.I.C., Ph.D. (London).
Agricultural Officer: C. G. Glegg, Dip.Hort. (Wye).
Experimental Officer: A. Sreedharan, B.Sc. (Travancore).
Research Assistant: Mrs. I. C. Walker.

CENTRAL REGIONAL RESEARCH CENTRE, ILONGA

(P.O. Box 6, Kilosa)

Senior Research Officer: T. O. Robson, B.Sc. (Witwatersrand).
Botanist: D. J. Turner, B.Sc. (Agric.) (Reading), Ph.D. (Edinburgh).
Chemist: K. G. Pickles, M.Sc. (Newcastle-on-Tyne).
Agricultural Officer (Irrigation): J. T. Barton, B.Sc. (California).
Agricultural Officer (Experiments): R. A. Haggarty, B.Sc. (London).
Field Officer: J. B. Tile.
Field Officer: I. D. Armstrong.

The following officers are seconded from the Empire Cotton Growing Corporation:—

Plant Breeder: R. Smith, B.Sc. (Manchester).
Plant Breeder: J. E. Cross, B.Sc. (Wales), M. S. (Minnesota).
Plant Breeder: T. Bradley, B.Sc. (Liverpool).

(a) Mbozi Experimental Station

Senior Field Officer: J. I. Thompson.

(b) Seatondale Experimental Station

Agricultural Officer: B. Walker, B.Sc. (Nottingham), Dip.Agric. (Reading), D.T.A. (Trinidad).
Field Officer: J. F. F. Lumsden, S.D.A.

(c) Lumemo Sub-Station

Field Officer: T. Apiyo, Dip.Agric. (E.A.).
Agricultural Officer for Pyrethrum Research: D. F. Osbourn, B.Sc. (Agric.) (Reading), stationed at Njombe.
Field Officer: M. J. Simmonds.
Field Officer: K. J. Rwiza, Dip.Agric. (E.A.).

WESTERN REGIONAL RESEARCH CENTRE, UKIRIGURU

(Private Bag, Mwanza)

Senior Research Officer: D. G. Jones, B.A., Dip.Agric.Sci. (Cambridge), A.I.C.T.A.
Pasture Research Officer: G. D. Scott, B.Sc. (Witwatersrand).
Entomologist: I. A. D. Robertson, B.Sc. (Aberdeen).
Agricultural Chemist: J. Evans, B.Sc. (Wales).
Agricultural Officer (Experiments): J. N. Auckland, B.Sc. (Agric.) (Reading).
Experimental Officer: G. A. Semiti, B.Sc. (Makerere).
Field Officer: D. F. L. Rose, U.D.A., C.D.A.
Field Officer: R. Naburi, Dip.Agric. (E.A.).

The following officers are seconded from the Empire Cotton Growing Corporation:—

Chief Scientific Officer: G. M. Wickens, B.Sc. (Agric.) (Reading), D.I.C., Ph.D. (London).
Plant Breeder: M. H. Arnold, M.A. (Cambridge).
Plant Breeder: K. J. Brown, B.Sc. (Reading).
Plant Pathologist (Temporary part-time): K. M. Arnold, M.A., Ph.D. (Cambridge).
Chemist: A. M. Kabaara, B.Sc. (Makerere), M.Sc. (Aberdeen).

(a) *Maruku Experimental Station*

Agricultural Officer: H. W. Mitchell, B.Sc. (Agric.) (London), D.T.A. (Trinidad).
Field Officer: W. C. M. Maxwell.

(b) *Mwanhala Experimental Station*

Field Officer: T. J. Aldington, N.D.A., N.D.Agric.E.

(c) *Urambo Experimental Station*

Field Officer: T. Muir.

NORTHERN REGIONAL RESEARCH CENTRE, TENDERU

(P.O. Box 3020, Arusha)

Senior Research Officer: H. J. Van Rensburg, M.Sc. (Witwatersrand).
Entomologist: G. Swaine, B.Sc. (Sheffield).
Plant Breeder: B. G. Houston, B.Sc. (Agric.) (Aberdeen), Dip.Agric., Sc. (Cambridge), D.T.A. (Trinidad).
Plant Pathologist: P. K. S. Clinton, B.Sc. (Sheffield).
Plant Pathologist: D. A. Burdekin, B.A. (Cambridge).
Agricultural Chemist: G. D. Anderson, M.Sc. (Agric.), Ph.D. (Durham).
Agricultural Officer (Experiments): J. C. Macartney, B.Agric.Sc. (Belfast).
Field Officer: G. L. Goodhew.

(a) *Horticultural Experimental Station, Amani*

Agricultural Officer: B. L. Honess, B.Sc. (Reading), D.T.A. (Trinidad).

(b) *Ikoya Sub-Station*

Field Officer: M. McQueen, N.D.A., S.D.D., S.D.A.

SOUTHERN REGIONAL RESEARCH CENTRE, NACHINGWEA

(P.O. Box 43, Nachingwea)

Senior Research Officer: B. C. Akehurst, M.B.E., B.Sc. (Agric.) (Reading).
Entomologist: M. Bigger, B.A. (Trinity College, Dublin), D.T.A. (Trinidad).
Plant Breeder: A. K. Aukland, B.Sc. (Durham), Dip.Agric.Sc. (Cambridge), D.T.A. (Trinidad).
Agricultural Chemist: B. Anderson, M.Sc. (Agric.) (Reading).
Agricultural Officer: P. J. Northwood, B.Sc. (Agric.) (Reading).
Zoologist: H. J. de S. Disney, B.A. (Cambridge).

COMMODITY STATIONS

(Staff Secondment)

Sisal Research Station, Mlingano

(P.O. Ngomeni)

Financed by Tanganyika Sisal Growers Association

Senior Research Officer: E. C. Diekmahns, B.Sc. (Glasgow), Dip.Agric.Sc. (Cambridge).
Agricultural Officer: C. M. H. Atkins, B.Sc. (Agric.) (London).
Field Officer: R. J. Bumpstead.

Coffee Research Station, Lyamungu
(P.O. Moshi)

Financed by Tanganyika Coffee Board

Principal Scientific Officer: J. B. D. Robinson, B.Sc. (Reading), F.R.I.C.

Entomologist: B. G. Tapley, B.Sc. (London).

Horticulturist: L. M. Fernie.

Field Officer: S. O. Pyman.

Field Officer: J. M. C. Brownbridge, N.D.A., M.B.A.C.

Pasture Research Station, Kongwa

(P.O. Kongwa)

Financed by Tanganyika Agricultural Corporation

Pasture Research Officer: M. A. Owens, B.Sc. (Agric.) (Wales), Dip. Agric. (Reading), D.T.A. (Trinidad).

SOIL FERTILITY

In the second test cropping season of an experiment at Ilonga (IL 1), comparing four types of fallow cropping, the results confirm those of the first season, mainly, that fallowing for 1, 2 or 3 years has no advantage over continuous cropping for maintaining yields on the soil at the Central Regional Research Station. In the fifth year of the rotation-continuous cropping experiment (IL 2), the yields of rotated crops showed no distinct advantage of rotation over continuous cropping.

TABLE I

YIELDS OF THREE CROPS IN ROTATION AND CONTINUOUS CROPPING. LB. PER ACRE					
			Rotated		Continuous
Cotton	...	...	686	...	507
Maize	...	...	2,118	...	2,150
Sorghum	...	...	377	...	320

As a result of re-organizing the farm, the permanent fertility experiment, described in last year's report laid down to study the value of fertilizers and farmyard manure has been abandoned and another one started on a new site.

At Mwanhala, Nzega District, rainfall was good and well distributed. In the phosphate-farmyard manure residual experiment (MWA. 1) maize showed appreciable residual effects at averaging 250 lb. per acre to farmyard manure applied in 1956/57 and to phosphate, averaging 320 lb. applied in the same year.

The value of applying farmyard manure or fertilizers either every year or in alternate years is clearly shown in Table II. Both were applied in 1960.

TABLE II

YIELDS OF MAIZE AND GROUNDNUTS FROM CONTINUOUS AND ALTERNATE APPLICATION OF FERTILIZER OR FARMYARD MANURE. LB. PER ACRE. (3rd Year)					
			GROUNDNUTS		
MAIZE					
	Continuous	Alternate	Continuous	Alternate	
6 tons FYM ...	3,135	2,927	1,360	1,251	
3 tons FYM ...	2,727	2,135	1,225	1,067	
Fertilizers* ...	2,678	1,827	1,140	962	
Control ...		1,009		602	

*100 lb. double superphosphate, with 100 lb. sulphate of ammonia in addition for maize.

Similar results were obtained in another experiment (MWA. 3), Table III.

TABLE III

YIELDS OF THREE CROPS FROM CONTINUOUS APPLICATIONS OF FARMYARD MANURE AND FERTILIZERS
ALONE AND TOGETHER. LB. PER ACRE (3rd Year)

			Intercropping		
Pure Stands					
	Castor	Maize	Groundnuts	Maize	Groundnuts
Control ...	313	1,216	812	313	448
FYM ...	1,125	1,893	1,279	2,155	519
Fertilizer* ...	653	2,975	1,253	1,868	447
Both... ..	1,345	3,673	1,325	3,063	426

*100 lb. of double superphosphate, with 100 lb. of sulphate of ammonia in addition for maize in pure stands and intercrop.

In the intercrop, groundnuts did not respond to farmyard manure or fertilizers, but the maize did.

In a third experiment (MWA. 13), farmyard manure or fertilizer increased production appreciably for two varieties of groundnuts and soya bean. Castor bean only responded to farmyard manure in this experiment.

In the Minjingu phosphate experiment (MWA. 11), an excellent residual response to 500 lb. per acre applied in 1959 was given by groundnuts, i.e. 425 lb. per acre and maize 1,100 lb. Residual responses to 100 lb. of double superphosphate were lower, 280 and 520 lb. per acre.

At Nachingwea, rainfall was high and reasonably well distributed. In the fertility experiment (NACH. 3) comparing farmyard manure, the ash of an equivalent amount of farmyard manure and fertilizers, the results shown were substantially similar to those reported last year, namely all treatments improved yields appreciably, there were no appreciable differences between farmyard manure and its ash, but responses to fertilizers were not generally lower than those to farmyard manure.

In the heavy lime experiment (NACH. 2) maize for the third year gave miserable yields, 100-340 lb. per acre, as usual. In the first two years the presence of lime tended to reduce groundnut yields. This year a positive response to lime has been shown for the first time by soya beans which were substituted for groundnuts, the average increase being 490 lb. per acre.

In the farming systems experiments (NACH. 6, 7, 8) now in their third year, there is no sign of any reductions in yield on plots not receiving manure or fertilizer for any of crops planted. There is a suggestion that farmyard manure and fertilizers may be having a cumulative effect in increasing yields and that this effect is greater for dung.

Burning stover (sorghum) stooked or not stooked, showed no depression of yield on a following maize crop compared with ploughing under or removing and ploughing in the stubble.

At Tengeru, the continued application of 5 tons of farmyard manure, sulphate of ammonia and superphosphate alone and together since 1953 have not given any permanent improvement in maize production (TEN. 5). Neither has the burial of the stover had any beneficial effect. Table IV shows the residual responses to the treatment in 1960 when the manure and fertilizers were not applied.

TABLE IV
RESIDUAL RESPONSES BY MAIZE TO CONTINUED APPLICATION
OF FARMYARD MANURE AND FERTILIZERS FOR SAME YEAR

Previous Treatments	Stover buried	Stover removed
Control yields	3,010	3,311
Responses to:—		
250 lb. sulphate of ammonia ...	—344	0
80 lb. superphosphate	—344	—602
Both above	—205	—473
Farmyard manure	—205	—43

In the experiment to compare various methods of cropping newly broken grassland (TEN. 2) it was found in the first two years of the experiment that maize was a most unsatisfactory crop. In the first year no cobs were produced, in the second a yield of only 200 lb. per acre even when nitrogen and phosphate were applied. On the other hand seed beans produced good crops in both first two years, averaging 750 lb. per acre which compares favourably with the average yield for the area.

SOIL STUDIES

A detailed soil survey of the Maramba Estate, Tanga Province, was carried out in connection with cocoa production. The growth of established cocoa was considered in assessing the usefulness of soils for further planting. Seven soil series with twenty-two phases have been differentiated. It was found that compact zones in profiles appeared to be related to base depletion and low calcium-magnesium ratios. In surface soils there is usually at least twice as much exchangeable calcium as magnesium whilst in compact sub-soils the ratio seems nearly always to be less than one.

A reconnaissance soil survey of some 49,000 acres in the Eastern Usambaras foothills was carried out with a view to cocoa expansion. The soils fitted well with the Maramba classification. Cocoa trial plots were established in the area in April and a close correlation is being shown between actual growth and that predicted from soil examination and analysis. Many of the soils have been cultivated for a long time and a fertilizer programme is being implemented to provide basic data on the crop's requirements. More promising areas for cocoa than the long-cultivated Bondei area have been examined and it is hoped that the soil survey will be completed in 1961.

Soils from many land-use schemes have been examined in the laboratory and some in the field also. Soil samples from the rice growing areas at the Ikowa Irrigation Scheme show increases in salinity over the past three years. Surface samples from the calcareous grey soils on the same scheme suggest that crop failures may be due to magnesium deficiency.

Studies have begun on the Tengeru run off plots, the control grass and simple bund plots appear to be much lower in available phosphate than those with bananas, coffee and more bunds. These results do not appear to correspond with the results for run off and soil loss. The grass plot has least run off and soil loss with control and coffee having the highest. The phosphate content of the soil may also be related to the amount of crop being removed, grass giving a high rate of removal and coffee and bananas a low rate.

On the completion of the field work for the Rufiji Basin Survey, the Agricultural Chemist, Nachingwea, spent the first half of the year completing soil analyses and writing up a comprehensive report on the soils of the area. Six weeks were spent at F.A.O. headquarters, Rome, co-ordinating the soil report with other sections of the complete report and assisting in the preparation of soil maps.

IRRIGATION

At Kalimawe, Tanga Province, three leaching trials are in progress to study the local problems of salt removal. Laboratory studies are also in progress. Trial I compares a 15 in. leaching before planting with no pre-planting leaching. Cotton gave yields of 736 and 959 lb. per acre respectively. Turkish tobacco gave high yields of useless leaf, aroma was lacking. Hibiscus and jute yields were very low in both cases. Sesame germinated well but then wilted and died off. Maize yields were 650 and 430 lb. per acre respectively. Mosaic resistant cassava is not yet ready for harvesting but shows a high percentage breakdown to mosaic disease. Onions alone gave worthwhile yields, 8,675 and 5,810 lb. per acre respectively.

In trial II, a 30 in. pre-planting leaching was given. Irrigation in every furrow or in alternate furrows gave yields of 990 and 930 lb. of maize per acre. Two tons per acre of gypsum gave 700 lb. of maize.

In trial III bunding gave higher yields of maize than ridging, 1,130 as against 690 lb. per acre.

Laboratory investigations show that the degree of salinity varies appreciably from place to place but there is a general increase near the lake. Here, permeability is much poorer than up the slope towards the main channel and is related to the higher salt content and somewhat heavier soil texture.

Percolation rates vary considerably according to site but all are very low. The addition of two tons of gypsum per acre had no effect on the percolation rate of soil near the main canal but doubled it on the more impervious soil.

At Uru Chini, Moshi District, a wide range of crops were planted. Cotton again gave high yields of 1,490 lb. to 1,680 lb. per acre. Chillies also yielded well, 618 lb. of dried fruit per acre and still more to pick, all of good quality. Two varieties of onions, de Wildt and Bombay Red, gave yields of over 7,000 lb. per acre and garlic gave 3,870 lb. Yields of hibiscus fibre were low, 500 lb. per acre and the crop will not be grown again. Yields of white haricot and seed beans were poor. Sesame failed. Lucerne yielded well giving a hay yield equivalent to approximately four tons per acre.

INTERCROPPING

Castor "bean" is often planted late in the season so an experiment was carried out at Ilonga to see whether intercropping early planted groundnuts and soya bean with castor at three dates of planting would give increased production per acre.

Early planted castor reduced yields per acre of early planted groundnuts and soya but intercropping gave an overall gain. Medium and late planted castor did not reduce yields of soya or groundnuts but castor yields were severely reduced by soya.

TABLE V
THE EFFECT OF INTERCROPPING CASTOR WITH EARLY PLANTED SOYA AND
GROUNDNUTS. YIELDS IN LB.

Castor Planted	Yield from 1 acre of intercrop			Yield from two half acres in pure Stand		
	Castor	Groundnuts		Castor	Groundnuts	
16th January	476	...	500	268	...	936
20th February	350	...	1,146	279	...	-
14th March	295	...	1,098	300	...	-
	Castor	Soya		Castor	Soya	
16th January	473	...	994	268	...	1,614
20th February	84	...	1,708	279	...	-
14th March	26	...	1,700	300	...	-

WEED CONTROL

Simazine, Atrazine and a 2, 4-D ester were tested as pre-emergence sprays on maize, tall sorghum, groundnuts, cotton and sesame at Ilonga. Lack of rain for a month immediately after applying Simazine and Atrazine reduced their effectiveness. Simazine showed no effect on weed or crop emergence. The results from Atrazine were similar except for a severely reduced plant population on sesame which is shallow planted. 2, 4-D ester gave a good measure of weed control on all plots but cotton plants were severely distorted and gave a reduced yield. A secondary invasion of weeds in March was not controlled by any of the treatments.

In trials of Eptam to control nut-grass at Tengeru encouraging results were obtained; time of application in relation to soil moisture and depth of incorporation in the soil are important factors. A very high degree of control was obtained by incorporating the granular formulation into the soil to a depth of one foot when the soil is dry but when there is a reasonable chance of intermittent showers occurring during the following fortnight.

A wide range of herbicides were screened for pre-emergence weed control in haricot and seed beans. Five showing considerable promise have been selected for further work.

CONTROL OF TERMITE DAMAGE

The promising results obtained last year using Aldrin as a seed dressing and mixed with fertilizer for reducing termite damage to crops were followed up. To a certain extent the results are disappointing since increases in yields similar to those obtained last year were not found. However, there were appreciable increases in plant populations and since in years when rainfall is not as good as in 1960 high populations usually give higher yields than low populations, the results obtained are of importance. It is thought also that in a wet year termites do not attack living plants to nearly the same extent as during a dry one. This was noticed particularly in the case of soya bean where the plants were not attacked until the end of the season whereas last year the attack began in the second week after planting, as is usual.

Dieldrin was also tested and appeared promising.

There is a suggestion of a decline in yield of soya bean at the higher rates of application of Aldrin and Dieldrin applied with fertilizer.

It was found in this work that Aldrin seed dressing gave a very good protection to sunflower seed during a mouse attack. Plant populations were increased from 6,160 to an average of 11,180 per acre.

INVESTIGATIONS OF LOCAL INTEREST

At Wami, Morogoro District, yields of maize and sunflower were reduced appreciably from plantings after the middle of February. Soya bean yields, however, were maintained at a planting made in the middle of March. Sesame and sorghum experiments were ruined by waterlogging, insects and birds. In an intercropping trial with maize and sesame it was found that the yield of maize was not reduced but that of sesame was very greatly reduced except in the case of the local variety which yielded 540 lb. per acre in pure stand and 200 lb. when intercropped.

At Duthumi, Morogoro District, yields of maize fell off rapidly for plantings later than mid-February. At plantings later than mid-January yields of groundnuts and sesame (local and Morada) were lower than from earlier plantings.

At Mtopwa, Newala District, groundnuts gave a response of 100 lb. of kernels to 1 cwt. of single superphosphate over a basic yield of 645 lb. Maize yields were generally low, of the order 400-700 lb. per acre. Cobbing percentages were very low, 20-30. It is probable that low fertility and a heavy attack of *Striga* were the main causes of this.

Two experiments comparing ridge and flat planting at three planting dates, with sesame and hill rice, gave interesting results. At the early planting, 29th December, yields were for flat planting 598 and 1,346 lb. per acre respectively. At the last date, 26th January, they were 271 and 807 lb., thus a delay of only one month in planting led to a considerable loss of yield. Yields and plant populations were lower on ridges at the early planting date, losses being 246 lb. per acre for sesame and 301 lb. for hill rice. At the last date of planting, plant populations and yields were similar. Losses in plants and yields from early planting were due to erosion of the ridges. In another experiment comparing flat, ridge and furrow planting with hill rice the following results were obtained.

TABLE VI
EFFECT OF PLANTING METHOD ON PLANT POPULATIONS
(000s/ACRE) AND YIELDS IN LB. PER ACRE, FOR HILL RICE

Planting Method	Population	Yield
Flat	35.9	1,261
Ridge	36.4	768
Furrow	28.3	772

In this experiment flat planting had the same plant population as ridge planting but gave a much higher yield. Many plants were washed out of the furrow planting but the yield was the same as for ridge planting. The results obtained are the reverse of expectations based on observations during growth. There was, however, a suggestion that *Striga* grew better on the ridge.

In observation plots, two varieties of soya bean produced over 1,200 lb. per acre, Msumbiji sorghum 1,840 lb. and West Nile sunflower 1,440 lb. when planted in early January.

At Suluti, Songea District, an experiment (SUL. 1), has been started to determine the best place for fire-cured tobacco in rotations based on local crops and starting from newly cleared miombo forest. In the first year, groundnuts, millet and maize gave good yields, cowpea and tobacco yields were low, the latter producing 250 lb. per acre. In a time of planting experiment on tobacco, early plantings gave 800 lb. per acre.

Local maize yielded as well as Katumbili; Natal Common and Asiriya Mwitunde groundnuts gave much higher yields than local, 1,380, 1,192 and 844 lb. of shelled nuts per acre respectively. Morada sesame yielded 444 lb. as against 21 lb. per acre for local. Soya beans yielded very well, 1,200-1,800 lb. per acre.

Nearly 100 tobacco plants were chosen and self-fertilized for plant improvement studies.

At Mbozi, Mbeya District, 1 cwt. of double superphosphate and 1 cwt. of sulphate of ammonia gave useful increases in maize yields of 834 lb. and 535 lb. per acre for early and late December plantings. Two selections from local beans gave yields of over 1,000 lb. per acre and three selections from local cowpeas gave useful yields ranging from 700-900 lb. per acre averaged over two sowing dates. Various varieties of pea-beans gave yields of 800-1,200 lb. per acre but all except one were of poor quality and the exception was only of fair quality. Seed beans were severely attacked by rust and gave low yields. Trial plots of sesame failed and dwarf soya beans gave disappointing yields this year, the best being 524 lb. per acre.

TRIAL MANAGEMENT FARMS

At Mwanhala the trial management farm has been laid out and fenced as a separate unit of about 40 acres. Nine acres are cropped each year and after three crops have been planted the land is put down to a mixture of Rhodes-Cenchrus grasses. Three acres are newly ploughed out of grass each year and a similar acreage planted.

Thus on the farm we have rough grazing, improved grazing and crop residues to maintain 10 head of cattle, including work oxen, and these in turn produce farmyard manure to improve the productivity of the arable break.

A labour force of three men (an approximation of the output of an average family), had little difficulty in carrying out the work required, but extra labour had to be employed at harvest time to prevent losses of soya, cowpea and sunflower.

The following yields were obtained.

TABLE VII
YIELDS IN LB. PER ACRE

	FOOD CROPS			CASH CROPS		
	Yield	Acreage	Value	Yield	Acreage	Value
			Shs.			Shs.
Sorghum ...	275	1½	37/50	Sunflower...	560	1
Maize ...	1,789	1½	121/95	Soya ...	262	1
Groundnuts	660	-	300/00			
Cowpea ...	483	1	66/00			

Intercropped with Sorghum and Maize. Cost of extra labour Shs. 57/50 (23 days at Shs. 2/50 per day).

Three acres of cassava were planted but will not be harvested until the second year.

The cost of extra labour absorbed the income from the cash crops which yielded rather poorly whilst the food crops produced at only subsistence levels.

A start has been made at Ilonga on a trial management farm where cotton will be the main crop. Three acres were cleared and planted to cotton, maize and groundnuts in the first year.

CROPS COTTON

Agronomy.

In experiment 26 at Ukiriguru the previously applied treatments were slightly modified to compare the value of 100 lb. per acre of sulphate of ammonia applied in the ridge before planting and the same amount as a top-dressing in the presence and absence of phosphate and farmyard manure. The average response to the application before planting was 219 lb. of seed cotton per acre. Top dressing, however, gave a much greater response, 367 lb. per acre.

It would appear that top dressing is more suitable as the full effect of the nitrogen appeared 3-4 weeks after application, at the time of maximum leaf area and rainfall. When nitrogen was applied before planting there was a reduction in leaf area expansion accompanied by a lowering of the percentage of leaf nitrogen during March and April when the crop was setting.

A range of varieties was planted at different dates. No striking differences were found between varieties as regards reduction of yield at the later planting dates. The application of sulphate of ammonia increased yields but showed no effect in reducing the trend of declining yield at the later planting dates.

At Ilonga the results from a series of demonstration plots showed clearly the value of good husbandry for producing high yields. Early planted (February) 3×1 foot spacing, sprayed cotton, yielded 1,240 lb. of seed cotton per acre, dusted cotton 850 lb. and without pest control 333 lb. cotton widely spaced, late thinned and weeded once at the end of the rains only gave 30 lb. per acre.

Three permanent fertility experiments were planted in the Eastern Province. No responses were shown in two, perhaps owing to poor rainfall. In the third, superphosphate and sulphate of ammonia, 1 cwt. per acre of each, gave a very high and significant response of 1,109 lb. of seed cotton. Farmyard manure at 5 tons per acre gave a high but not significant response. In a series of 30 trial plots on African gardens in six areas, the yield of cotton was improved by the application of fertilizers in 29 cases. The mean increases from 100 lb. of superphosphate and 100 lb. of sulphate of ammonia, applied separately were 217 and 199 lb. of seed cotton per acre respectively. No mean increase was shown when both were applied together.

Plant breeding.

Testing of the more recent Ukiriguru seed issues continued over the full range of Lake Province conditions. The results are summarized below:

TABLE VIII
PERFORMANCE OF SEED ISSUES RELATIVE TO Mz.561

	HIGH RAINFALL			AREA Ginning %	LOW RAINFALL			AREA Ginning %
	Lint lb./acre	As % of Mz.561			Lint lb./acre	As % of Mz.561		
Mz.561	225	100	...	31.4	162	100	...	32.5
Uk.51	294	131	...	32.5	233	144	...	34.1
Uk.55	304	135	...	33.8	264	163	...	35.3
Uk.58	321	143	...	34.1	264	163	...	35.4

It can be seen that the yield increases from the seed issues have been very appreciable in both areas and that they are relatively greater under the drier conditions of the south than under the wetter conditions of the north. This year's results have given ample confirmation of the higher ginning percentages of the new issues.

In certain localities in the south there were striking demonstrations of the improved jassid resistance of the new seed issues leading to yield increases of 3-8 times that of Mz.561.

Albar hybrids were also included in these experiments. Their yields were, at least, of the same order as that of Uk.58, and in a few cases appreciably higher. The first objective of this programme has now been achieved, namely, the production of bacterial blight resistant strains yielding up to the standard of the most recent seed issue when the disease is at a minimum.

Reselections from 1958 and 1959 material were tested at Ukiriguru and further all round improvements were shown. Lint testing on these strains is being continued.

In a variety trial at Ilonga, 100 selections made between 1956 and 1958 were tested and increases in yields up to 42 per cent above Il.58 were obtained. Ginning percentages ranged from 32.0 to 35.7 per cent (Il. 58=31.7 per cent). Lint indices generally were higher than for Il.58. In the 1959 selections ginning percentages up to 40 per cent were recorded.

The better selections made between 1954 and 1957 were tested at eight sites in the Eastern Province under three levels of pest control, spraying, dusting and no control. Some selections showed little or no improvement over Il.58, a few showed average increases of the order of 20 per cent.

Twelve selections which have been tested over several years and shown improvements over Il.58 were mechanically mixed in various proportions and combinations to constitute eight mixtures for testing as possible commercial issues. They showed a mean increase of 23 per cent over Il.58 which yielded 235 lb. of lint per acre and all had an appreciably higher ginning percentage. Lint index was also higher but jassid resistance was variable.

Complaints that there has been some deterioration in the quality of 47/10 seed were investigated. The possibility exists that local selection pressure may have altered the original genetic population in the different growing areas. The results of an experiment showed clearly that little, if any, change has occurred. It also showed the great superiority of Il.58 over 47/10, the former giving an increased yield of 67 per cent over the mean of 47/10 from eight ginnery zones.

Plant protection.

The annual survey of *Fusarium* wilt in Lake Province shows that the disease continues to spread, the number of infected holdings having increased about four times during the last three years. The disease occurs predominantly close to the shores of Lake Victoria but it has been found at places 10-15 miles inland and on soils other than the light sands. It has been found for the first time in holdings east of Mwanza Gulf and Smith Sound, in Ihale, Bukumbi and Manawa Zones. One infected plant was found at the Regional Research Centre. Approximately two per cent of the holdings in Geita District are infected.

The issue of seed produced in the infected area is forbidden and this has probably reduced the rate of build up. It has been found that almost fifty per cent of the seeds taken from diseased plants can be internally infected.

A suspected outbreak of *Fusarium* wilt in Arusha District was shown to be caused by *Verticillium* wilt.

The level of bacterial blight infection was generally low at Ukiriguru, but even so the importance of resistance was clearly demonstrated in an experiment designed to study this. An early seed issue, Uk.46, showed a loss of 120 lb. of seed cotton per acre at the higher level of bacterial blight infection but later issues did not show any reduction in yield.

Examination of trash in the fields in early November showed the causal organism was in a highly pathogenic state in early November. Work on hill sand and mbuga soils has shown that provided the trash from a previous crop is buried by ridging or ploughing there is little likelihood of significant infection in the ensuing crop on either soil type. Where little pre-planting cultivation is practised, trash-borne infection will be at a low level provided that there has been periodic wetting by 3-6 inches of rainfall the month before planting.

In Eastern Province a survey of the incidence of bacterial blight showed, on 28 holdings, that 42 per cent of the plants had angular leaf spot, 14 per cent stem lesions and 11 per cent petiole lesions. The symptoms were most prevalent in late plantings where cotton had been grown successively for several years.

Varieties resistant to bacterial blight have been introduced from Ukiriguru and from Nyasaland and Nigeria. Some of the introductions have yielded as well as the Ilonga strains and given ginning percentages up to 38.

Spraying eight times with one lb. of D.D.T. per acre at Karangai and Himo-Makuyuni in Northern Province generally brought about a marked decrease in numbers of bollworms and flared squares but there was no worthwhile increase in yield.

TABLE IX
EFFECT OF SPRAYING ON INTERCROPPED COTTON AND MAIZE, URU CHINI.
LB. PER ACRE

			YIELD FROM ONE ACRE OF INTERCROP		YIELD FROM TWO HALF ACRES IN PURE STANDS	
			Cotton	Maize	Cotton	Maize
Sprayed	...	...	380	820	380	510
Not sprayed	...	...	300	820	360	510

There was no loss of cotton from intercropping and there appeared to be a slight gain in maize production. Last year there was a definite reduction in cotton yield from intercropping.

HIBISCUS

Hibiscus trials were carried out on the Manyara estate, Mbulu District. Planted in March, the variety E.C.R. grew away from a heavy weed growth of *Amaranthus tricolor*, but the growth of Laos was greatly reduced. At harvest E.C.R. was 10-15 feet high. Cutting was successfully done with a semi-mounted reciprocating mower with a crossbar mounted so as to push off the cut stems in a different direction from the direction of cutting. In this way one acre could be cut and stacked in 4 hours.

Modifications to a ribboner improved its performance and the above crop was dealt with at the rate of one acre in 7-8 hours with a team of nine labourers.

Two cement lined, brick retting tanks were constructed, one with a heating system installed. In spite of careful temperature and pH control a really successful ret was not obtained. To remove bark completely over-retting was necessary with subsequent weakening of the fibre. A simple prototype washing machine was made by T.A.M.T.U. which could wash a "strick" of retted ribbons clean in 30-45 seconds.

An average yield of 857 lb. of fibre per acre from 3½ acres was obtained.

Breeding and Selection.

Fifteen introduced varieties were sown at Tengeru and ten were discarded as unsuitable. All undesirable plants in the remaining five were removed and seed from the remainder released for bulking at Manyara.

COFFEE

Agronomy.

Robusta

At Maruku, the effects on yields of growing bananas with coffee appear to be much greater in Robusta than Arabica in the first bearing year, virtually no Robusta being produced and Arabica was reduced from 33 lb. per acre to 10 lb. The young coffee trees had no effect on banana yields (MAR. 10).

In the establishment experiment (MAR. 5), second crop year, lime alone, and also where fertilizers (NPK) had been applied in the planting hole, gave appreciable and significant increases in yield. Farmyard manure applied in the planting hole (Nov. 1956) has increased yields appreciably in the absence of fertilizers and lime and also when fertilizer was only applied in the planting hole in the absence of lime. At Kaibanja where the soil is more fertile, shade, mulch, farmyard manure and nitrogen have not produced any noticeable effect yet (Exp. MAR. 19).

Farmyard manure is in short supply in Bukoba. Swamp soil was tested as a substitute but so far does not appear promising for either coffee or bananas, at 80 lb. per hole. Chemical analysis suggests that swamp soil has a low potash content.

In the Pruning and Variety Experiment (MAR. 17), the two Uganda varieties "Nganda" and "Erecta" are producing much larger beans than "Maruku Local".

Arabica

In the three variety experiments (MAR. 12, 13 and 14) the Kents varieties showed considerable resistance to leaf-rust but the SL varieties generally gave higher yields. Copper spraying has been introduced into these experiments to assess losses from leaf-rust in the different varieties.

At the Mbozi Experiment Station some very good yields compared with previous years were obtained even though the season was not particularly favourable.

In the variety experiment (MBO. 1) stripping in 1959 has not resulted in any loss of crop, since the mean 1960 yield was 2.6 cwt. of clean coffee per acre as against a total of 2.4 cwt. for 1959 and 1960 from those not stripped. The trees which have been stripped in 1959 and 1960 appear to be more vigorous than those not stripped or stripped only in 1959.

The variety experiment (MBO. 19) on Ngamba Estate was pruned hard after last year's heavy crop, mean 8.6 cwt. and the majority of the stems were near the end of their cycle. This year's mean yield of 4.5 cwt. was good in the circumstances. P280/21, until now the highest yielder, gave the lowest but one yield, 3.7 cwt. per acre. N39 and P280/21 are the highest mean yielders in this experiment.

In the hedge-coffee trial, planted 1956 and 1957, very high yields, for the station, were obtained. The younger planting yielded 13.8 cwt. per acre. Half of the older planting was watered throughout the dry season of 1959 and this caused a reduction in flowering. The watered area yielded 12.6 cwt. and the unwatered half gave 21.1 cwt. per acre.

Monthly sprays of a copper fungicide increased yield from 1.8 to 2.4 cwt. of coffee and the difference was very nearly significant (MBO. 7). Parathion applied with the fungicide did not increase yield although it checked a small leaf minor attack. The fungicide application gave a much improved leaf retention.

Off station trials with monthly copper spraying gave useful increases in yield.

TABLE X

COPPER SPRAYING			CONTROL		
cwt. per acre			cwt. per acre		
N'gamba	...	...	3.4	...	1.3
Mwolo 1	...	...	6.8	...	2.2
Mwolo 2	...	...	9.2	...	3.6

At Mwolo, the sprayed plots have tended to overbear and severe dieback has occurred in some cases.

Four-year-old irrigated coffee gave nearly double the yield of unirrigated, 6.5 cwt. as against 3.8 cwt. The irrigated trees suffered from a severe attack of crinkle leaf early in the year. Irrigated two-year-old coffee yielded at a lower rate than unirrigated since irrigation tended to suppress flowering.

At the Mitalula sub-station flowering on the three experiments planted last year has been very heavy and controlled stripping will be necessary.

Plant Breeding and Selection.

Yield records are being kept of some of the more promising trees at Mbozi. Seed and cuttings are taken from the highest yielders.

A new type of dieback has appeared at Mbozi and is of considerable importance. It occurs in October–December being preceded by a shedding of all but the youngest leaves. If the affected branches do not die they are very much shortened. Subsequent branch production higher up the tree is often normal and the tree then presents a "waisted" appearance.

TEA

Agronomy.

In the tea establishment trial planted out in November, 1957, at Maruku, nitrogen and farmyard manure applications have given very good frame formation and growth. Very little flush was produced during the dry season but the rate of production increased from October onwards. Yields of over 300 lb. per acre of made tea were produced during the nine months since tipping by the plots receiving the above treatments. Only 180 lb. was produced on the natural soil.

The presence of shade trees (small *Albizia stipulata* and *Maesopsis eminii*) appear to reduce yields but mulch and sulphate of ammonia increase yields and result in a much higher percentage of establishment of bushes.

COCOA

Plant Protection.

Newly planted cocoa in Tanga Province was free from serious disease. A fungus *Ustulina zonata*, attacked trees in newly cleared plantations probably due largely to over-mulching round tree bases. There has been no confirmed case of black pod.

CASHEW

Agronomy.

In the Southern Province, recordings are being made of the yields of reputedly high-yielding trees, as possible sources of high-yielding clonal material. A detailed study is being carried out to find a more reliable airlayering technique than is available at present. It is essential that the layers be ready for planting out during the early part of the rainy season. Layering before November is not very satisfactory but 80 per cent success has been achieved from both green and hard wood in November. These took 50-60 days to mature and so were ready to plant during the early rains. No success has been achieved in attempts to root cuttings.

Further work on the value of planting seed of high specific gravity confirms former conclusions that it produces very much better trees, taller, wider stems, more nuts and earlier fruiting than unselected seed.

Studies of the yield and botanical characters of trees from eight individual selected trees show that there is very great variation between trees within a "family" and this variation obscures any real differences that might exist between families. Only two out of the eight lines showed any uniformity of apple characters, suggesting that there may be a high percentage outcrossing. When inflorescences are covered by cotton bags to prevent insects gaining access to the flowers no nuts are formed. In two cases, ants accidentally entered the bags and nuts were produced.

Records from six plots of cashew, at Lulindi, each with trees varying in age showed yields ranging from just over 500 to 1,130 lb. per acre. The average tree number per acre was 41 and the trees met overhead in a thick canopy. Such yields appear to be low when compared with yields of 700-800 lb. per acre from trees 3-4 years old grown under plantation conditions.

The foreign cashew collection, planted in 1958 is yielding interesting results. Varieties introduced from Jamaica are yielding appreciably less than our own. Three varieties from Ceylon yielded at the same level as local but the nuts are appreciably larger.

A spacing and fertilizer experiment has been started on newly planted cashew at Nachingwea and on 4-year old trees on an estate. A trial has been started to study the value of thinning closely planted trees which only bear on the surface canopy and produce low yields. Several such trees have been cut down to nearly ground level and at four feet to see if it is possible to prune suckers which emerge from the stumps so that reasonably shaped trees are formed with good bearing potential.

It is costly to pull out large trees. Tests with an arboricide showed that, by frilling at the base of the trunk and spraying the trunk for 2½ feet above this in December, the trees were dead or nearly dead in the following March.

Plant Protection.

The early start of the rains led to an extensive build up of *Helopeltis* all over the Southern Province.

It is clear that single sprayings are useless in controlling *Helopeltis*, in two spraying trials it was found that the sprayed areas did not yield higher than the unsprayed areas. There was a later attack by *Helopeltis* and this may have caused more damage to the sprayed trees which would have borne a greater number of fresh young shoots so attractive to *Helopeltis*. It is also possible that the spray applied in June when flowering had already commenced had an adverse effect on pollinating insects. The effect of a late attack of *Helopeltis* on yield was shown on a block of trees which in 1958 and 1959 yielded 637 and 799 lb. per acre but only 153 lb. in 1960.

PYRETHRUM

Agronomy.

In experiments, at Uwemba, to test the value of nitrogen, phosphate, potash and ground limestone on four soil types, the highest yields, in the first year, were given when phosphate and limestone were applied, an average increase of 47 per cent over the control yield of 189 lb. of dried flowers per acre. Several types of phosphate were compared on two soils, superphosphate proved superior to Minjunga phosphate at equivalent amounts of citric soluble P_2O_5 in the first year.

All pairs of the following treatments, fallow, wheat, peas, lupins and maize were tested as two-year prior treatments for pyrethrum. The first season's cropping had no effect on the yields of flowers in the second year of pyrethrum and but little on the two-year total, lupins tending to reduce yields. The second year's cropping, however, showed that lupins tended to reduce pyrethrum yields compared with the other crops in the second year of pyrethrum. This reduction being appreciable, some 85 lb. of dried flowers per acre, on the combined yield of the two years. Two years cropping with lupins gave the lowest yield. Wheat appears to be a suitable crop to take before pyrethrum.

In two experiments comparing the value of green manure, peas, wheat, with and without fertilizers and fifth year pyrethrum in the year previous to planting new pyrethrum, the fertilizer applied to the previous crop had a valuable residual effect, 55 and 75 lb. of dried flowers per acre. Both wheat and peas with fertilizer were followed by high yields of pyrethrum in one experiment. In the other, green manure with fertilizer gave the highest yield of pyrethrum closely followed by wheat and peas. In this experiment the peas and wheat grew poorly and this may explain the apparent success of green manure here.

Cutting back in March, April or May in addition to November reduced yields, over three years, considerably: 255, 348 and 396 lb. per acre respectively.

Treatment of cuttings with Seradex B, Nos. 12 and 3 had no effect on rooting in the presence and absence of $2\frac{1}{2}$ per cent Aldrin at 50 lb. per acre at West Kilimanjaro. After five weeks only 3 out of 960 cuttings had died.

Time of cutting back was studied. Cutting back in April or May gave the highest yields. Cutting back in November or April and November reduced yields from 1,000 lb. to just over 600 lb. per acre for a planting made in June, 1959.

A spacing of 12 in. gave a significantly greater yield, 450 as against 316 lb. per acre, than 24 in. in the first year.

Breeding and Selection.

Recording continued on 84 selections planted in 1959 and a further 377 were planted in January, 1960, in Uwemba. In both sets a number of clones gave yields in 1960 that were nearly double that of the appropriate mean yield. Appreciable variation was shown in pyrethrin content, the percentage of diseased buds and the numbers of flowers picked. It appears that selection alone may bring about a great improvement in production.

In the Northern Province two hundred selections were planted in clonal rows in April. Here again considerable variation in flower number and size was recorded. Two of the selections produced a very pale-coloured extract which could be a desirable characteristic in the formulation of aerosols.

TOBACCO

Flue-cured

Agronomy.

At Urambo a more comprehensive programme than that of the previous year was carried out.

High topping increased yields and quality appreciably as compared with normal, low, and none. Ridge size, broad or narrow, had no effect on yield or grade index for the varieties Hicks and White Gold.

Two rates of nitrogen (11 and 33 lb. N per acre) were tested at seven dates of planting. On both red and grey sub-soil types the yields of the first planting, early November, were considerably increased with the higher rate, 266 and 307 lb. per acre respectively, but grade index was slightly reduced. At the mid-November and later plantings the higher rate of application did not give any significant increases in yield. Three different forms of nitrogen, urea, sulphate of ammonia, nitrate of soda and a mixture of the latter two, gave similar yields at three rates of application, 22, 44 and 66 lb.

In experiments comparing three levels of N, P and K in all combinations, nitrogen and potash gave appreciable increases in yield but nitrogen also reduced grade index on the grey sub-soil.

TABLE XI

EFFECTS OF APPLICATIONS OF NITROGEN AND POTASH ON YIELD, LB. PER ACRE, AND GRADE INDEX ON GREY SUB-SOIL

Potash lb. K per acre	Nitrogen lb. N per acre					
	0	...	22	...	44	Means
0	500	...	720	...	766	662
50	439	...	945	...	804	729
100	523	...	860	...	1,022	801
Means	487	...	842	...	864	
Grade Index	3.01	...	2.73	...	2.18	

On the red sub-soil rather different results were obtained, nitrogen and phosphate gave significant increases in yield.

TABLE XII

EFFECTS OF APPLICATIONS OF NITROGEN AND PHOSPHATE ON TOBACCO YIELDS. LB. PER ACRE

Phosphate lb. P per acre	Nitrogen, lb. N per acre					
	0	...	22	...	44	Means
0	413	...	611	...	431	485
60	501	...	754	...	649	635
120	592	...	756	...	614	654
Means	502	...	707	...	565	

In the rotation experiment (URB. 2), tobacco after grass gave the highest yield and appreciably better quality, a grade index of 2.22 as against 1.70. The types of crop grown previously had no effects on yield or quality nor did the application of fertilizer to previous crops have any significant effect.

TABLE XIII

THE EFFECT OF PREVIOUS CROPPING AND FERTILIZER APPLICATIONS ON TOBACCO YIELD. LB. PER ACRE

1958		1959		No Fertilizer	Fertilizer
Grass	...	Grass	...	...	425
Sorghum	...	Maize	...	251	283
Maize	...	Groundnuts	...	242	280
Groundnuts	...	Castor	...	263	234

Fire-cured

At the Suluti sub-station, yields were rather low in a date of planting experiment, 812 and 588 lb. per acre for mid and late December. Yields from later plantings fell off rapidly to 320 for early February. An experiment to determine the best place for tobacco in a rotation of local crops has been started.

Plant Protection.

Leaf curl on Turkish tobacco was found at Moshi. Frog-eye spot was frequent at Urambo but no Anthracnose was seen.

COCONUTS

Plant Protection.

Premature fall of nuts and a calyx-end rot from which suspected *Phytophthora palmivora* and *Gloeosporium* spp. were isolated, continued to occur near Tanga. Surveys are proceeding to assess losses from these diseases.

GROUNDNUTS

Plant Protection.

In a trial at Mwanhala, Rogor 40 appeared to show some promise for controlling rosette disease on a susceptible variety.

SESAME

Agronomy.

At Wami and Duthumi (Eastern Province) the "local" variety outyielded Morada by 200 and 160 lb. per acre respectively. In three spacing experiments at Nachingwea, Morada gave yields of 860, 747 and 753 lb. per acre compared with 143, 40 and 58 for Local. Morada has been grown in trial plots in various parts of the country generally with great success and there are many requests for seed. Sesame failed to grow satisfactorily at Olmolog.

Plant Breeding and Selection.

Over 6,000 F3 lines of various crosses were grown at Nachingwea. Three crosses appear to be giving some promising plants, Morada with Local or Venezuela 51 or 52. F2 bulks of various multicrosses and back-crosses were grown. The small programme attempting to produce an indehiscent variety by back-crossing Rio $\times$ Morada to Morada continues.

Plant Protection.

Alternaria and *Cercospora* continue to attack the leaves of most sesame varieties, the former being particularly damaging when the soil remains wet for some time. Mildew (*Oidium* sp.) was frequent on irrigated sesame.

LINSEED

A limited number of Canadian varieties were grown at Olmolog in 1957, the yields were rather low, about 3 bags per acre. The world collection, some 1,600 varieties, has been obtained by the Northern Regional Research Centre to see if any are likely to give an economic yield of some 6-7 bags per acre.

SOYA BEANS

Agronomy.

Studies on the effect of different plant populations at varying row and within-row spacings are giving interesting results at Nachingwea. Populations between 50,000 and 130,000 plants per acre generally give the highest yield, but in addition the actual spatial distribution appears to be having an unexpected and probably important effect on yield. Within reasonable limits, the spatial distribution of plant populations has not been found to affect yield in other crops but with soya beans at low populations a close spacing in the row may reduce yield considerably. Blends of two or three varieties may prove more productive than single varieties.

Oil and nitrogen determinations have been done on several hundred breeding lines to find lines having an appreciably higher oil content than the usual 18 per cent.

At Tengeru, three of the four Rhodesian varieties tested gave yields of over 1,000 lb. per acre when planted in March. Plantings a month later yielded about 400 lb. lower. Only two of the seven Nachingwea varieties produced a little seed, the other five produced a mass of vegetative growth only.

Plant Breeding and Selection.

A number of the most promising early selections were grown in small bulk on a T.A.C. production farm at Nachingwea. All yielded appreciably higher than Hernon Nachingwea and were harvested 7-12 days earlier than that variety.

Plant Protection.

Mosaic, a virus disease, was identified for the first time in Tanganyika.

HARICOT BEANS

Agronomy.

A very comprehensive programme to find a haricot bean suitable for canning and resistant to bean rust was started at the Northern Regional Research Centre and shows considerable initial success. A wide range of varieties were imported for testing and submitted to tests for rust resistance, canning size, soakability and various agronomic characters.

On varieties provided by the U.S. Department of Agriculture it has been shown that two races of bean rust exist here, one at Moshi and one at Tengeru. Neither of these is the same as any of the 30 races occurring in U.S.A.

Eight varieties found to be resistant in the field and to have suitable canning characteristics were tested against both races under laboratory conditions. All varieties showed complete resistance to both races.

Hard seed or non-soakability has been shown to be primarily a genetic characteristic. Some varieties soaked 100 per cent after storage at high temperature and low humidity.

Sufficient seed of some varieties was received for yield estimates to be made, estimates varied from 1,600–2,800 lb. per acre when grown in small plots.

VELVET BEANS

Twelve selections (ex Mpwapwa) were planted with maize at Tengeru in March. Several varieties of velvet beans produced over 2,000 lb. per acre, but yields of maize were negligible. One variety was outstanding for vegetative growth but had a low seed production.

Three varieties were planted with a short-term maize in the short rains. Although only 2.8 in. of rain fell during the period of crop growth, the maize yielded two bags per acre. The velvet beans withstood the dry conditions and came away quickly at the onset of the long rains. A long-term maize was interplanted and produced about 1,000 lb. per acre, the velvet beans yielding from 1,185 to 2,099 lb. per acre.

Although the variety Local Black can produce yields of about 3,000 lb. per acre of seed, its forage production is not particularly high and it produced only 970 lb. of crude protein per acre as against 1,460 lb. for the variety which produced a luxuriant vegetative growth.

Velvet beans are too long in maturing to plant in the long rains. Seed production was found to suffer at the expense of vegetative growth. The crop is very drought resistant and has been observed to be able to survive on short rains of 3–5 in. By interplanting maize early in the long rains the crop is supported to encourage seed production of the velvet bean.

MAIZE

Agronomy.

It has often been noted that even in well-grown maize a high proportion of the plants do not bear cobs. A preliminary survey has been carried out to gain some information as to what factors may be causing failure to cob. It seems clear that the following factors are involved.

Spacing:—at very wide spacings cobbing percentages may be high (about 90).

Soil fertility:—cobbing percentages are low on poor soil (20–30), high on better soil (80), or when fertilizers or farmyard manure are added (90–97).

Time of planting:—cobbing percentage can fall off rapidly at later planting dates.

Moisture stress:—under irrigation cobbing percentages can be very high (95–98).

An understanding of the reasons determining cobbing percentage is important in connection with the plant breeding programme.

Monthly plantings of maize at Tengeru were carried out from January to November. Yields were highest for February to April, 3,780, 3,330 and 3,270 lb. per acre, dropping to low yields, 1,060–1,690 lb. for September to January. An average of two cobs per plant were produced when yields were high but average cob weight was higher when yields were low.

Plant Breeding and Selection.

It seems unlikely that a short-term maize variety suitable for Tanganyika can be found from such types in other countries as most are very susceptible to leaf blight (*Helminthosporium turcicum*) and are often low yielding here. The earliness required has not been found in East African material and so a crossing programme has been started to combine the earliness of introduced varieties with the disease resistance and yield characteristics of local types. Two programmes have been started one for high and one for low altitudes.

Two of the short-term varieties introduced a few years ago will be grown in multiplication plots with a view to release in 1961/62 in small quantities. These varieties yielded over 2,000 lb. per acre at Nachingwea and about 1,200 lb. per acre at Ukiriguru.

RICE

Breeding and Selection.

Ten varieties of high altitude rice from the Central Rice Research Institute were bulked up at Tengeru. A few of the varieties appear to be promising, showing evenness in date of flowering and ripeness to harvest, strong straw and non-shattering. The samples of seed received were too small to obtain estimates of yields per acre.

WHEAT

Plant Breeding and Selection.

The search continues for new varieties resistant to leaf and stem rust to replace varieties under cultivation whose resistance is breaking down. In 1961 approximately 95 per cent of the acreage planted will be sown with varieties that have been selected in the present programme. There were 806 varieties under test in 1960 of which 119 appear to be worth further trials. Besides established sources for obtaining new varieties, the Plant Breeding Station, Nova Lisboa, Angola, has sent 88 varieties.

Two varieties were released for the 1960 long rains planting and have performed well, one yielding from 11–15 bags and the other 12–18 bags per acre. Unfortunately both varieties are beginning to show susceptibility to rust. One variety has been released for the 1960/61 short rains planting. Promising current varieties come from Mexico, Kenya, Minnesota and South Africa.

A check has been kept on progress in other lines of research to combat the rust problem i.e. chemical control, interspecific and intergeneric crosses. Some of the current promising varieties belong to the two latter categories.

SUGAR CANE

Plant Protection.

An open quarantine station has been established at the Northern Regional Research Centre to receive material issued from the East African Quarantine Station, Muguga. Sugar cane smut was found for the first time in Tanganyika at Arusha Chini. Possible sources of infection are being investigated.

PASTURE

At Ilonga hand-mattocking reduced the number of woody species in natural grassland better than any of the other treatments described below and a very good burn was obtained. A rotary mower cut all species neatly but regeneration of woody species occurred and grass growth was retarded sufficiently to give only a fair burn. A bush breaker knocked down all species but regeneration of woody species occurred. A high proportion of grass plants (*Panicum maximum*, *Hyparrhenia rufa* and *H. filipendula*) were uprooted and only a very poor and patchy burn was obtained. 2, 4-D ester in dieselene, applied late February, showed promise for controlling some troublesome species—notably *Harrisonia abyssinica* and *Markhamia obtusifolia*. A very good burn was obtained.

At Tengeru, a large area of permanent grassland containing a high population of a number of species of *Acacia*, about 220 per acre, was improved with the use of an arboricide, 1:60 mixture of 2:4:5 T in dieselene. Bushes or trees with an accessible main stem or trunk were frilled as near to the ground as possible and the wound treated with arboricide. A 95 per cent kill was obtained. Bushy types were sprayed to run off but with a lower degree of control, 31 per cent. *Lippia* sp. and *Lantana* sp. were severely defoliated by a mixture of 2:4 D and 2:4:5 T but eventually recovered.

At Maruku the "Rweya" grassland fertilizer experiment (MAR. 7) was completed. As in previous years responses were shown to nitrogen and potash. Limestone gave an appreciable response having been applied four years previously.

Plant Breeding and Selection.

A large number of single plants of Rhodes grass were established at Tengeru in 1959, and 126 selections were made. The growth habits showed tremendous variation and the following types were most noticeable: upright forms with few runners, some are very leafy and would be excellent for fodder hay or grazing; spreading forms producing masses of quick rooting runners with remarkably satisfactory swards; combined upright and spreading forms in which the upright part is tussocky and the runners root only sparsely. Further selection is in progress to eliminate plants susceptible to leaf rust, stemmy types, slow growing plants and to select types resistant to drought.

The yield potential of some plants appears to be very high, an equivalent of 10 tons of dry matter per acre from small plots.

